The Impact of Exposure Classification Strategies and Water Consumption Information on Exposure Estimates of Water-Borne Contaminants

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The use of population-level indices of exposure to estimate individual exposures is an important limitation of previous epidemiologic studies of disinfection by-products (DBPs). Through a cooperative agreement, an international collaborative effort with scientists from the U.S. Environmental Protection Agency (U.S. EPA) and universities in the United States and the United Kingdom was established to refine exposure assessment methods for a prospective epidemiologic study of spontaneous abortions and DBP exposure. Using computer simulations (n = 1000), we examined potential exposure misclassification resulting from the use of system average DBP concentrations to estimate individual exposures by comparing metrics incorporating water intake and filtered and bottled water use data. We also evaluated exposure categorization techniques using DBP percentiles to determine which approaches were most susceptible to misclassification. We examined three trichotomous (median, tertile, and 40 percent) exposure classifications and fourth approach which utilized four exposure groups. Compared to more direct exposure estimates incorporating water intake, bottled water use, and 90% filtration efficiency, approximately 50% of subjects were misclassified across one category (e.g., from high to intermediate or from intermediate to low) based on system average concentrations. Average misclassification across at least two exposure categories (e.g., from high to low) ranged from 3–8% for the trichotomous categorization approaches and 13–16% for the fourth approach. The median classification strategy was the most robust approach, resulting in less exposure misclassification. Water intake was the most influential exposure modifier that we examined since it impacted DBP exposure estimates for all of the subjects in the simulation study (n = 100). These data indicate the potential magnitude of misclassification resulting from the use of indirect exposures to estimate individual ingestion levels and reinforce the need to collect water consumption information in epidemiologic studies. This study and related efforts should help reduce some of the uncertainty in risks reported from epidemiologic studies of DBP exposures and reproductive and developmental endpoints. Appropriate classification of water consumption is critical in determining the risks to DBP exposures occurring at national, regional, state, and local levels.

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